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BUSINESS CASE ANALYSIS OF THE SPECIAL OPERATIONS AIR MOBILITY VEHICLE

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December 2013

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13. ABSTRACT (maximum 200 words)

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Several manufacturers produce this commercial aircraft. They are Air Creation USA, Airborne, Evolution, Concept Aviation, Manta Aircraft S.A., and Northwing Design. This project has three objectives: (1) describe the WSC aircraft and its capabilities. Assess its benefits and costs relative to the V-22 Osprey, the newest troop transport helicopter, and the US Air Force (USAF) Predator, an Unmanned Aerial Vehicle Drone; (2) perform an industry analysis of the WSC training and aircraft sales industry; and (3) determine the expected government training capabilities and costs.

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BUSINESS CASE ANAYLSIS OF THE SPECIAL OPERATIONS AIR MOBILITY VEHICLE

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BUSINESS CASE ANALYSIS OF THE SPECIAL OPERATIONS AIR MOBILITY VEHICLE

ABSTRACT

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LIST OF ACRONYMS AND ABBREVIATIONS

ACTD	Advanced Concept Technology Demonstration
AFB	Air Force Base
AFT	advanced flight training
BRS	Ballistic Recovery System
CIA	Central Intelligence Agency
DoD	Department of Defense
GAO	Government Accountability Office
GSA	General Services Administration
IFS	initial flight screening
IGE	independent government estimate
IW	irregular warfare
JPO-UAV	Joint Program Office for Unmanned Aerial Vehicles
O&M	operations and maintenance
OA	opposed access
PFT	primary flight training
RAG	Replacement Aircrew Group
SNA	Student Naval Aviators
SOAMV	Special Operations Air Mobility Vehicle
SOCOM	Special Operations Command
SOTACC	Special Operations Terminal Attack Controllers Course
TBO	time between overhaul
TMDE	Test Measurement and Diagnostic Equipment
USAF	U.S. Air Force
WSC	weight shift control

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EXECUTIVE SUMMARY

Special Operations Air Mobility Vehicle (SOAMV) is the military term used to describe the weight shift control (WSC) aircraft. The WSC aircraft is a type of light-sport aircraft that has certain characteristics that distinguish it from the more vague aircraft industry segment of light-sport aircraft. The WSC aircraft consists of three major but simple parts: the wing, the carriage, and the pilot. Everything about this aircraft is based on simple, portable, and inexpensive concepts with very little use of modern technology. This keeps the costs down and maximizes the basics of aviation to include calling on the skills and training of the pilot. Several manufacturers produce this commercial aircraft. They are Air Creation USA, Airborne, Evolution, Concept Aviation, Manta Aircraft S.A. and Northwing Design. This project has three objectives: (1) describe the WSC aircraft and its capabilities, and assess its benefits and costs relative to both the V-22 Osprey, the newest troop transport helicopter, and the U.S. Air Force (USAF) Predator, an Unmanned Aerial Vehicle Drone; (2) perform an industry analysis of the WSC training and aircraft sales industry; and (3) determine the expected government training capabilities and costs.

The U.S. military faces numerous threats and mission requirements in today's world of irregular warfare (IW). Each one calls on a different weapon system or platform to provide mission success. This project determined there is a need for the Osprey and Predator to carry out certain missions; and also determined that there is a capability gap with opposed access (OA) that requires the SOAMV. In the process of analyzing the training industry, the project brought to light that small, one or two person-training centers are the standard across the U.S. Additionally, a regionalized customer base and overall low demand creates a relatively non-competitive industry. Another major factor affecting the industry, is the Federal Aviation Administration's recent inclusion of the WSC aircraft into the light-sport aircraft category. This inclusion has added costs and time to training and has reduced demand dramatically. For the aircraft sales industry, similar dynamics were found.

Finally, this project looked at current military aviation training and the future training structure of the SOAMV, its ideal training location, and associated costs. The project specifically looked at the Navy's SH60 helicopter training program, which showed a mix of military and civilian trainers involved in the different phases, with civilians instructing student pilots in the first year and military pilots instructing in the second year. This arrangement works well for a training program like the SH60, because of the time it takes to master basic flight skills and then move on to advanced weapon systems training.

In the case of the SOAMV, the required training is only three weeks. The much shorter training program is due to the simple nature of the WSC aircraft, and the fact that it does not have military weapon systems. Considering those two aspects of the aircraft, the need for military instructors is greatly diminished. The author contends that three civilian and three military instructors on staff is the right mix for this program. Both civilian and military instructors have unique skill sets that students would benefit from. The numbers of each could fluctuate by one, but at all times there should be at least two of each. Additionally, Yuma Proving Ground was selected as the best location based on optimal training conditions, installation support services, and value to taxpayers. The first year costs for a schoolhouse in Yuma were estimated to be $2,638,132.00, with ongoing annual costs estimated at $1,535,132.00. The author generated these cost estimates using comparable costs from the Military Free Fall school in Yuma, AZ.

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I. INTRODUCTION

On 6 August 2011, the highest number of U.S. Special Forces personnel killed in a single incident in the history of the Special Operations Command occurred in Afghanistan. A Chinook CH-47, carrying 33 passengers, along with five crewmen, was shot down by Taliban insurgents. Of the 33 passengers, 25 were American Special Forces personnel. This is not an isolated incident; there have been several smaller crashes since 2001 in Afghanistan and Iraq that have claimed the lives of elite warriors. When a soldier of this caliber has been lost, the military not only loses a service member, but also an asset it has invested millions of dollars in. Because of their extensive training, Special Forces personnel require millions in military resources. The risks associated with transporting highly trained Special Forces personnel into high-threat environments using helicopters will be further examined in the following pages. In addition to looking at monetary costs associated with losing military personnel, this chapter will assess costs of air assets currently in use by the U.S. military.

In his 2009 JFQ essay, “Striking the Right Balance,” Secretary of Defense Robert Gates argued that the nation’s ballooning defense budget would force us to strike a balance between meeting our national security challenges and living within our means. He stated, “We cannot expect to eliminate risk through higher defense budgets—in effect to ‘do everything, buy everything.’ Resources are scarce, yet we still must set priorities and consider inescapable tradeoffs and opportunity costs.” Spending lavishly on expensive weapon systems that cannot meet government test standards, or, in many cases, provide more than what is required, needs to be addressed and corrected. Additionally, he emphasized that the increase in funding for special forces needs to continue. He recognized the cost effectiveness of using a small number of forces to do critical tasks using proven and mature technology will save a tremendous amount of money (Gates, 2009, p. 1).

The next section of this chapter will provide background on the Predator and its positives and negatives in the U.S. military. The same discussion for the V-22 Osprey will follow this section. In the final section of this chapter, the new option—the Special

Operations Air Mobility Vehicle (SOAMV)—will be introduced. What missions the SOAMV can perform, and why, will be discussed in this section.

A. DRONES: HOW THEY CONTRIBUTE TO THE FIGHT

A single U.S. Air Force (USAF) owned drone (Figure 1), from the Predator series just recently passed 20,000 flight hours. This is a remarkable feat considering the short history of this weapon system. USAF operators applaud the reliability and performance of this intensely used aircraft. Predator 107 (P107) achieved the groundbreaking mark on May 5, 2013 while taking part in a 21-hour combat mission in support of Operation Enduring Freedom in Afghanistan (Maguire 2013). Reliability and performance are the key attributes of this technological marvel that the U.S. government has been experimenting with since the early 1980s. Both the Central Intelligence Agency (CIA) and the Department of Defense (DoD) saw the positives of this quiet, lightweight, and discreet aircraft. The first official development contract was awarded to the General Atomics Aeronautical Systems Company in January 1994. The Advanced Concept Technology Demonstration (ACTD) phase lasted from 1994 to 1996, with the government purchasing 12 aircraft and 3 ground control stations (Pike, 2002).

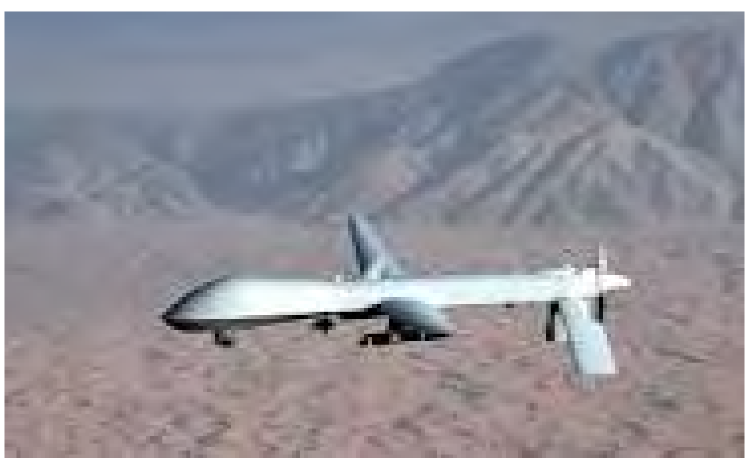

Figure 1. Predator Drone (from Mortimer, 2011)

During exercises in the U.S. in 1995, successful use of the ACTD aircraft led to the deployment of the aircraft to the Balkans that same year. During this time period, the

Predator program fell under the Navy's Joint Program Office for Unmanned Aerial Vehicles (JPO-UAV), with operations conducted by a joint Army/Navy team. The transition from an Army/Navy led program to an USAF-led program took place in the late 1990s (Pike, 2002).

The USAF acquired 60 Predators by 2001, losing 20 during operations. Icy conditions were to blame for almost all of the lost aircraft. De-icing systems were then installed along with an upgraded turbocharged engine and improved avionics. These improvements greatly enhanced the durability and survivability of the aircraft. The USAF designated the MQ-1 variant in 2002. The "M" stands for multi-role to signify the different functions the aircraft has taken on. (Pike, 2002)

Moving beyond reconnaissance and into precision strike capabilities, the MQ-1 has become a special weapon to conduct irregular warfare operations. The author's argument for a new option—the SOAMV—is related to the munitions aspect of this aircraft. Performing kinetic missions with an unmanned weapon system creates a host of challenges with diplomacy and winning the hearts and minds of civilian populations in the Middle East and across the globe.

To avoid the issues caused by the munitions aspect of drones, using the Predator and other drones solely for reconnaissance missions and other non-lethal military operations appears to make sense. The United States still gets remarkable value out of the $20 million drones, even without using them to kill high value targets (Booth, 2013). The level of intelligence gathering and battlefield monitoring that the aircraft can do with such a small cost to the DoD is astounding. Military personnel are able to operate them from trailers on stateside military installations. In 2012, according to Under Secretary of Defense, Robert Hale, it cost $850,000 to feed, house, and secure one military service member operating in Afghanistan for one year (Shaughnessy, 2012). By having military personnel perform their missions from home bases the government is eliminating that expense. This would not just be the controller of the aircraft, but it would also include the other personnel that would have to be doing the intelligence gathering in the war zone. This could be the Army soldier on the ground or the P3 aircrew that is gathering intelligence from the sky.

Drones are not a 100 percent solution to IW. In addition to the heavy financial costs that drones incur, the DoD must also consider the negative consequences of launching strikes from thousands of feet in the air. The U.S. has greatly reduced the chances of soldiers getting killed when drones are used to kill high-value targets, but that comes at what cost to the overall goal in the war against terrorism? The DoD has moved toward a "star wars" approach to engaging the enemy in Iraq and Afghanistan, but what has been lost in this movement is the recognition that there will always be a human element to war. The backlash from Afghani and Iraqi civilians losing innocent family and friends to drone attacks should drive the discussion of finding alternatives to such action.

B. THE OSPREY

The V-22 Osprey (Figure 2), with its diminishing capabilities but escalating costs, is a prime example of what Gates would like to avoid in the future in the acquisition world. The Osprey has two different models, the MV-22 and the CV-22. The MV-22 is used by the Marine Corps for logistics and troop movement, and the CV-22 is owned by the Air Force to support special operations. Both variants are similar, with both having tilt-rotor design that operates as a helicopter for takeoff and landings, and converts to a turboprop once inflight. The Osprey's (both MV-22 and CV-22 variants) features would allow it to operate on amphibious ships, aircraft carriers, and in combat zones carrying combat troops, supplies, and equipment.

Figure 2. Photo of Osprey (from Military-today.com, 2013)

Having begun in 1981 by the Army, the Osprey program faced its first challenge, one that will stay with it for the entire life of the program. This challenge is the cost of making an aircraft that operates as a helicopter for takeoffs and landings and converts to a turboprop aircraft once airborne and supporting those unique parts that make that possible. In 1982, the Army quickly backed out of the program because of cost concerns, transferring it to the Navy. Nearly a decade later, the Osprey was airborne for the first time; however, shortly after that first flight, the Secretary of Defense stopped requesting funds for the program, citing that the program was not affordable. Production stopped, but not for long. Congress did not agree with the DoD and continued to fund the project. Within a few years, Bell Helicopter Textron and Boeing embarked on a joint venture to begin producing production-representative aircraft to the Navy (Sullivan, 2009,).

Starting in 1997, Low-Rate Initial Production (LRIP) kicked off. Tests results for operational effectiveness and operational suitability were mixed in 2000. Navy testers concluded the Osprey passed both operational effectiveness and suitability tests, whereas the DoD's independent testers only had it passing the operational effectiveness tests. In December 2000, a Program Decision Meeting was scheduled. It never happened. Two fatal crashes occurred just before the scheduled meeting, grounding the aircraft and sending the program back to do more research and development, while continuing low-rate production.

More research and development led to aircraft modifications that fixed the safety concerns. In 2005, both Navy and DoD testers announced that the new, modified aircraft, passed both operational effectiveness and suitability tests. Full-Rate Production was approved by the Defense Acquisition Board in September of 2005 (Sullivan, 2009).

Successfully operating in 2007 and 2008 in Iraq, and in other austere deployed environments, the Osprey earned recognition by the Marine Corps for its extended range, speed, and payload in comparisons to the helicopters it is supposed to replace (Bolkcom, 2009). In 2009, the Osprey achieved Initial Operational Capability, but was still hounded by the lack of engine longevity. The Rolls-Royce engines were supposed to last "so many thousand hours" but were only lasting about 420 flight hours. Although the Osprey has come a long way, quality and safety challenges seem to linger (Bolkcom, 2009).

Due to design flaws, poor components, and support failures program costs continued to climb. In 2009, the GAO reported that the program, for its entire life cycle, is expected to cost $79 billion. This is while the total number of aircraft being procured has fallen from 1,000 to 500, resulting in a 148 percent increase in cost for each one. Included in this estimate are the operations and support costs that are expected to double over the life of the program (Sullivan, 2009,).

The Marine Corps has carried the Osprey forward as a critical piece of their mission in conducting traditional warfare despite its many failures and continues defects, not to mention its ballooning price tag. Skeptically accepting the Osprey as a necessary weapon system for the U.S. military, this author feels it only fulfills a handful of the total missions the U.S. military will face in the future.

C. WEIGHT SHIFT CONTROL AIRCRAFT: A NEW OPTION

Considering the irregular warfare (IW) threat facing the United States and what the Osprey and Predator have brought to the fight, this author sees the potential for a new military aircraft. This new aircraft is the Weight Shift Control (WSC) aircraft, with its military name being the Special Operations Air Mobility Vehicle (SOAMV). Opposed Access missions that require non-detection (both entering and exiting) are future missions that cannot be ignored and their success would greatly benefit from the use of the SOAMV.

Opposed access (OA) scenarios and environments are defined by Denial and Anti-Access strategies of the enemy. An example of this would be a high-ranking member of Al-Qaida living among his bodyguards and innocent civilians in a village in Pakistan. The high value target is surrounding himself with his militia, but is also using civilians as a shield from massive force (troops being delivered by Osprey) or a drone attack (Predator). In addition to these factors complicating the execution of the mission, which is to kill the high value target without killing civilians, the realization of radar technologies and mobile anti-aircraft weaponry (rocket-propelled grenades) is also of concern for the Osprey option. Special Operations Command (SOCOM) Commanders see this as an Area of Vulnerability in present and future conflicts (Kenny, 2012, p. 7).

The remainder of the thesis is organized as follows. Chapter II describes the aircraft, while Chapter III discusses the industrial organization of the aircraft sales market. Chapter IV presents the industrial organization of aircraft training, followed by Chapter V, which describes current military training for the SH 60 Helicopter. Chapter VI describes the ideal mix of civilian and military training; while Chapter VII describes the suggested government site and expected costs. Chapter VIII concludes with the main findings of the document.

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II. THE WSC AIRCRAFT DEFINED

The WSC aircraft is a type of Light-Sport aircraft with certain characteristics that distinguish it from the more vague aircraft industry segment of Light-sport aircraft. The WSC aircraft consists of three major, but simple parts: the wing, the carriage, and the pilot. As seen in Figure 3, everything about this aircraft is based on simple, portable, and inexpensive concepts with very little use of modern technology. This keeps down costs and maximizes the skills and training of the pilot. Specifications and capabilities of the aircraft draw mostly from the wing characteristics and engine size.

Figure 3. WSC Aircraft (from Start-Flying.com, 2013)

A. THE WING

The wing size changes the dynamic of the aircraft immensely and creates a tradeoff management process for the pilot. A WSC aircraft may be fitted with single (fabric only on top) or dual surfaced (fabric on top and bottom) wing. Dual surface wings perform better, but are less convenient when it comes to access to wing battens. Changing the wing size changes how fast and how smooth the aircraft flies and will also affect the payload. For example, an 11-meter wing will travel much faster and smoother, but carry far less payload than a 15-meter wing. The pilot only needs a few minutes and an Allen wrench to switch out or assemble the wings. Depending on the mission, you may need more payload capacity, or more emphasis will be placed on a smaller signature where non-detection is the priority (Kenny, 2012,).

The collapsible nature of the wings is the central element of one its most desirable features—portability. Transporting this aircraft to conflict zones across the globe is made easy by the fact the entire aircraft can be folded into a 5- by 10-meter crate. This portability can also be integrated into actual missions. One possible mission is for special forces personnel to parachute into a high risk area along with a crated WSC aircraft. Once the mission is complete the operator assembles the aircraft and flies out. This mission is similar to the way in which Small Boat Teams under Naval Special Warfare conduct maritime operations that require aerial delivery of boats and personnel from C-130 aircraft. This portability allows for flexibility in mission planning, and gives commanders the ability to use their operators in different ways.

B. THE ENGINE

The most popular engine in the WSC aircraft is the Rotax 912UL. The 80-hp engine is one of six variants of the 912 series. Development in the series has produced critical improvements in time between overhaul (TBO) and electric start options. TBO is a metric for readiness in all military aircraft, and an element that is scrutinized heavily. The electric start option allows the engine to be turned on and off while in flight. This is critical to missions that require zero detection caused by the noise of the aircraft. Additionally, high power-to-weight ratio, low fuel costs, and comparatively quiet operation make it an ideal fit for SOAMV. A mandatory engine overhaul must occur at the 2,000-hour mark of operations, which costs approximately $10,000. This cost is factored in to the $44 per-hour operating costs, which also includes all fuel, lubricants, filters, tires, and wing maintenance. With the Predator drones using the Rotax motors as well, possible synergies are available for procurement and maintenance.

C. SAFETY FEATURES

With the inexpensive nature of the Rotax aircraft, along with its size and weight, safety is a common concern. To minimize that concern, the aircraft has been outfitted with several features that aid in its safe use, and the survivability of the craft. Drawing on the basic design, the aircraft is essentially a powered glider. In the event of an engine failure, this allows the aircraft to operate and land safely without power. The FAA WSC Flying handbook illustrates how an aircraft with a 5:1 glide ratio, at an altitude of 5,280 feet, gives the pilot 78 square miles to land safely.

The second safety feature is that the carriage electrical system operates independently of the engine. This feature allows for an electronics failure with the avionics and communication equipment, without affecting engine performance. The final safety feature, and arguably the most comforting, is the Ballistic Recovery System (BRS). The BRS is an emergency parachute deployment system. In case of severe wing failure, or some other event that would cause loss of control, the BRS can bring the aircraft, and its crew, to a safe landing. It has been successfully deployed as low as 50 feet and as high as 6,000 feet (BRS Aerospace, 2013).

Now that we have discussed the reason for the aircraft and its characteristics in detail, Chapter III will discuss the training industry found in the United States.

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III. TRAINING INDUSTRY ANALYSIS

This chapter will look at the training industry using Porter's five forces of competitive strategy.[1] Porter (1979) contends five forces determine competitive characteristics and the extent of how competitive an industry is going to be. This model will aid in analyzing the industry to see whether it is capable of training Special Forces personnel in the safe and effective use of the WSC aircraft. It will also help determine whether a private training company is the best choice, versus establishing an in house government training school. This discussion of industry analysis draws entirely from Porter (1979). Accompanying market research was conducted using company and trade websites, along with the FAA resources and personnel communication with owners of training and aircraft sales companies.

A short summary of the training industry as a whole depicts an industry of low demand and slim margins. It is a fragmented, heavily-augmented, niche industry with many one-man operators who provide WSC training as a part-time job. Most trainers appear to do this more out of their passion for light sport aircraft than to earn a significant income. (T. Sipantzi, personal communication, October, 5, 2013; K. Blevins, personal communication, 7, October, 2013; R. Globensky, personal communication, October, 10, 2013)

A. THREAT OF ENTRY OR BARRIERS TO ENTRY

Barriers to entry for this "part time" industry are unique and plentiful, but certainly not impossible to overcome. The common barrier to entry is competing with a company that has achieved massive economies of scale, rendering the chances of competing on price difficult. Fortunately, for new start-ups, economies of scale in this industry are difficult, if not impossible, to attain. Single person, part-time, training

[1] Porter's Five Forces of Competitive Strategy are: 1) threats to entry or barriers of entry (further broken down by economies of scale, product differentiation, capital requirements, cost disadvantages independent of size, access to distribution channels, and government policy), 2) bargaining power of suppliers, 3) bargaining power of customers, 4) substitute products and 5) jockeying for position among current competitors.

companies are the norm in this industry. Following are several reasons why the industry has many single trainer outfits. First, the overall demand is low. WSC training industry has never been overly robust, but since the most recent economic downturn starting in 2008, the number of customers has dropped significantly. The companies in this industry do not have large reserves of funds; so many trainers close down their operations and search for a different job. An industry analyst might say that opens the door for stronger companies with cash to snatch up customers, which this author would agree with. The second reason economies of scale is difficult is a regionalized customer base. Customers are found evenly throughout the United States. Consequently, many independent, part time trainers are scattered throughout the country.

The third reason is the difficulty in finding qualified trainers to grow the business. The number of qualified instructors in the country is low, and safety and liability concerns further decrease the pool of qualified instructors. Additionally, insurance costs associated with safety and liability add another concern. Each qualified trainer will affect the insurance premiums.

A related concern to finding qualified instructors is the difficulty of physical distance between upper management located at the headquarters, and individual training sites. A training industry that is regulated by the Federal Aviation Association is under heavy scrutiny, so the distance between supervisors and compliance officials is a major hindrance to growth. Because the industry requires a lot of oversight and personal responsibility, one-man operations are the norm. With trainers mostly working for themselves, they eliminate the heavy administrative and management burden of trying to oversee operations that are often in another state. The reality of small, one-man operations is not just caused by the factors mentioned above. Culture of the trainers themselves has something to do with the single-person training companies. Many trainers enjoy their freedom and independence, and are often drawn to this venture because of their desire to work independently, and outside of the corporate life. Rooted in the independent culture, is an entrepreneurial spirit of innovation, trial and error, and risk taking.

If a training facility can establish a reputation for quality training, they will be in an extremely advantageous position. It generally takes three to four years to establish a quality training reputation, and one that travels through the industry and customer base. This requires a fair amount of financial backing to begin.

1. Product Differentiation

The second major source of whether the industry has barriers to entry is product differentiation. Three key ways in which training companies differentiate themselves are through a concentrated course schedule, experience and professional networking, and more importantly, a professional website. A concentrated course schedule separates the company from other competitors because students want to complete their training as quickly as possible. Since the majority of the instructors are doing this part-time, the training time is often stretched out. The second factor that greatly differentiates a training company is their experience level. With the inherent danger of taking flight, students want experienced trainers. Last, a professional-looking website gets students' attention, and provides a stronger first impression when they are evaluating various companies in their area.

2. Capital Requirements

The third category involves capital requirements. The cost of the standard training aircraft, is $60,000, explains Sipantzi (personal communication, October 5, 2013), while office and hanger rental space at airfields currently averages $500 a month, $6,000 for the first year. He also points out developing a website, buying insurance, and gaining licensing will cost a new trainer $2,000; other office equipment needed will cost another $2,500. This brings the capital requirements needed to $70,500 for the first year. Not a insurmountable number when considering trainers average $80 an hour, and the average student needing 20-hours of training to get certified. Typically, one student per month (industry average) would provide a trainer with a $1,600 a month in revenue. With this revenue stream and initial investment amount, capital requirements would not be considered a huge barrier to entry. (T. Sipantzi, personal communication, October, 5, 2013)

3. Cost Disadvantages Independent of Size

Addressing the category of cost disadvantages independent of size, location is key for two main reasons. The first one is weather. A warm, dry location with low winds will give a company the advantage of low cancellations, due to rain and winds. The second is having a training location that is easy to get to, and provides comfortable accommodations nearby.

4. Inability to Offer Low Costs

Given that the cost of training tends to be relatively standard, individual companies find it hard to reduce costs to the point where it gives them a huge advantage on price. If they do reduce their price considerably below their competitors, it actually works against them. Many customers prefer not to work with trainers that have bargain rates, because they see the cheap rates as affecting safety and quality of the training.

5. Distribution Channels

The fifth category in this section deals with access to distribution channels. Distribution channels would include hangers and professional, comfortable classroom facilities at airfields. They are considered to be at a premium at most airfields across the country, and tend to be a major barrier to a new operation. Established companies with classroom space have a considerable advantage in the market.

6. Government Policy

Government policy—the FAA's regulations—is a major factor in the growth of the market. Many trainers agree that getting access to an FAA examiner for the final student check ride is the hardest part of the training schedule. With only 13 FAA examiners currently certified in the country, getting students qualified quickly hinges on this access. Additionally, the FAA is making it increasingly difficult for these examiners to remain current. This will result in a lower number of certified examiners over the next several years, adding to this already delayed phase of the training program. This will negatively affect demand going forward (T. Sipantzi, personal communication, October, 5, 2013).

B. BARGAINING POWER OF CUSTOMERS

The second competitive force is bargaining power of customers (students). In this industry, the rates are set by the company, and are similar across the country. Since instructors are part-time and do the training because they enjoy the activity, prices are set as low as possible. The monopoly pricing gives this category a neutral mark for the industry because although the companies set their price, they are barely making a profit. Additionally, it does not bold well for competition.

For competition to increase, demand must also increase. If more students were searching for flight training hours, more trainers would be expected to work on a more full-time basis. Full-time operations would create economies of scale that would help pay down initial investments on aircraft and equipment, along with fixed costs such as office and hanger space at airfields.

C. BARGAINING POWER OF SUPPLIERS

The bargaining power of suppliers is a competitive force that is not dramatically relevant for the training industry. Training schools need aircraft, hanger, and office space, and small operational items like fuel and repair parts. In a way, the providers of these items would be considered suppliers. The supplier group for this case would be considered moderately powerful. The aircraft industry has enough manufacturers and product differentiation to limit their power when selling to training companies. If they increase their prices too much, trainers would move to the next company on their list. Additionally, the WSC aircraft does not have an extensive amount of unique technical characteristics that prevents trainers from switching to other aircraft.

Most airfields have a fair amount of power, because their hanger space and facilities are difficult to come by. If they want to increase prices and eliminate WSC trainers and their aircraft for bigger aircraft at their airfields, WSC training companies would be in trouble. In this manner, the military airfield could benefit a private trainer. If an arrangement were to be worked out between the military and private trainers where the private trainer was able to operate and store his aircraft, be given a classroom for nonflight training hours, and office space for daily business, the private trainer would then benefit from a stable environment, and a steady flow of customers.

D. SUBSTITUTE PRODUCTS

The substitute products category is tough to use, because there really is not a direct substitute for being trained on a WSC aircraft. Although there is not a direct substitute, there are a few possibilities for alternatives. A cheaper option would be to become trained on hang gliders or non-motorized aircraft gliders (i.e., Towed gliders). Going in a different direction with alternatives, a prospective student could become trained on a larger aircraft, and then downsize to a WSC. This would certainly cost more, but he would have more qualifications and options. This might make sense if you see yourself wanting to fly a bigger aircraft in the future. This would save a fair amount of time, because he would not be forced to re-learn the FAA material and standard aviation knowledge. Of course, there are nuances to the WSC that still have to be learned, but overall, there would be a time and cost savings. Another alternative, rather than a substitute for trainers, is to market the WSC aircraft experience as a vacation adventure activity. This could augment the student aspect of the business venture, creating another product line for the trainers.

E. JOCKEYING FOR POSITION AMONG CURRENT COMPETITORS

The final competitive force in Porter's model is jockeying for position. In the past, the industry contained more of this model, with more companies offering the service and competing on price. As discussed earlier in this chapter, in the last five years, the industry has become less competitive, as the overall demand for training has decreased. With slowing demand, many trainers have left the business, or are doing it part-time as a weekend hobby. Additionally, rates have gone as low as they can go for the trainers, so price competition is non-existent. Regional demand has also limited what the jockeying companies can do to capture more business from competitors. When the economy recovers, it will be interesting to see how this industry changes; but for now, it looks to be a slow-growth industry with a non-competitive element, driven by weak demand, low prices, and regionalization.

If the government were to contract their training, a realistic number that would be employed would be three. With only three civilian trainers hired as contractors, there would not be a recognizable change in the training industry. However, the attraction to train full-time and earn a wage far above the industry average, would generate interest from the best trainers in the country. Competition among civilian trainers would be intense for the opportunity to train U.S. Specials Forces (and possibly Special Forces from partner nations). What would temper the interest of civilian trainers would be the location of the training.

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IV. AIRCRAFT SALES INDUSTRY

The market research discussed here was conducted using company and trade websites, along with FAA resources and personal communication with owners of training and aircraft sales companies (personal communication with Sipantzi, October, 2013; Blevins, October, 2013; and Globensky, October, 2013.) Discussions of and references to industry analysis continue to draw from Porter (1979). Approximately 95 WSC aircraft are sold in the U.S. each year. The manufacturer's selling in the WSC aircraft category are Airborne, North Wing Design, Evolution, Air Creation USA, Concept Aviation and Manta Aircraft S.A. They are all U.S.-based companies except Airborne, which is located in Australia. Even though Airborne's headquarters is located in Australia, they have been a prominent player in the U.S. for years according to Sipantzi and Blevin. With dealers in several states, and annual sales estimated at $2,000,000. North Wing Design and Evolution are new players that are in the middle ranks for sales of the aircraft. North Wing Design's annual sales hover around $1,000,000 and Evolution's around $600,000. The other three are smaller outfits manufacturing and selling a combined 10% of the total sales (T. Sipantzi, personal communication, October, 5, 2013; K. Blevins, personal communication, Oct 7, 2013).

Selling the WSC aircraft as a manufacturer's representative or dealer is done at training schools by the trainers themselves. This is something that maybe a factor in full and open competition when it comes time to procure aircraft for training and real operations. The tendency will be for operators to push the procurement officials towards purchasing the aircraft the trainer sells because of the comfort level and familiarity. The average cost of the aircraft is around $40,000, which does not include customization and extras that are available (i.e., snow sleds, pontoon sleds, different wing configuration, parachute assembly). For the North Wing Navajo model, overall operating costs are estimated at $44 per hour (Kenny, 2012).

For all manufacturers, aircraft are made to order and delivery time is 8–12 weeks across the board. None of the manufacturers carries an inventory unless a cancellation occurs on one of the aircraft already being built. Repair parts for the engine and airframe tend to have a delivery time of four to six weeks.

A. THREAT OF ENTRY OR BARRIERS TO ENTRY

1. Economies of Scale

Much like the training industry, getting economies of scale out of a low demand, regionalized, and government regulated industry, is a difficult task. For these reasons, economies of scale is not considered a barrier to entry. Furthermore, since companies have a hard time reducing their costs by selling in large quantities, smaller shops can compete in their market and are considered a threat. That threat of entry is tempered by several barriers though, and will be discussed in the following paragraphs.

2. Product Differentiation

Under the product differentiation category, a barrier to entry for a new company is competing against a well-established, reputable manufacturer. It often takes decades to establish a reputation as a quality manufacturer; so when a new product comes along, it is difficult to get customers to give them an opportunity. This is unfolding currently between Airborne (the oldest and largest aircraft manufacturer), and Revo (a new company with a slightly progressive aircraft). Revo has received high marks for a sleek look and innovative features, but is struggling to compete with Airborne on sales. Customers fear an unproven aircraft and feel more comfortable with the more established one. Below are two comparable models from both companies.

Figure 4. The Revo Trike (WSC aircraft). Made in the USA by Evolution Trikes . Rotax 912 engine. Speed: 78 knots (90 mph). Range: 700 km (from Evolution.com, 2013).

Figure 5. The XT912 Tundra Arrow. Made by Airborne in Australia. Engine: Rotax 912, 4 stroke 80HP. Speed: 65 Knots. Range: 700 KM (from Airborne, 2013).

The second sub-category under product differentiation, is supportability, is closely tied to reputation. As mentioned in the previous paragraph, customers like the design of the Revo, but are unsure of the company, because it has only been making WSC aircraft for a few years. They fear that after buying a Revo, they would not be able to get the support they need, if the company were to shutdown or discontinue its product. Additionally, forming an expansive dealership network has been difficult for start-up companies like Evolution Trikes, maker of the Revo. The reasons for the difficulty boil to longevity concerns that will affect supportability. Dealers, just like customers, are wary of investing in an unproven company.

3. Capital Requirements

The next barrier to entry is capital requirements needed to start a dealership and grow the business. Prior to the economic recession in 2008, Airborne Inc.-made aircraft were being financed; however, financing for WSC aircraft is currently unavailable. This affects both established dealers and new ones. In the past, Airborne Inc. was the sole manufacturer to get financing based on their stability, dealer network and reputation for durability and reliability. Being the oldest and largest manufacturer made it seem like a safe bet for financing institutions. Lenders also liked the robust dealer network Airborne Inc. had established. This ensured support for maintenance and repair requirements. The final attributes that lenders appreciated were the durability and reliability that Airborne Inc. established with their aircraft. When the economy recovers, it will be imperative for competition and innovation that lenders give financing to all WSC aircraft.

4. Cost Disadvantages Independent of Size

Cost disadvantages, independent of size, can be another barrier to entry for many industries. For the aircraft sales industry, location and learning/experience curve have a significant impact on sales. Selling aircraft in a desirable flying location, like the Southwest, works well for sales. In the case of the learning/experience curve, dealers that sell a well-established aircraft benefit from knowing what matters to customers, and where cost savings can be achieved. The learning/experience curve advantage also combines with the common theme of reputation for safety, durability, and reliability. As discussed numerous times, reputation goes along way with customers and reduces the amount a company needs to spend on marketing.

5. Access to Distribution Channels

Access to distribution channels for selling aircraft is similar to training with regards to finding hanger space for display models and office space at airfields. Space at airfields is at premium, even in remote airfields, which is where most of the WSC aircraft sales and training is conducted. This situation causes a dilemma that is difficult to manage. To get customers you need to be near a metropolitan area, but the draw of much cheaper airfield space and a lower cost of living takes you hours from a major city.

6. Government Policy

The FAA's increasing regulatory requirements and certifications are becoming a major hindrance to certifying aircraft. This issue affects all dealers equally so it would be considered a neutral factor in the threat verses barrier category. This does affect competition dramatically though. Many part-time dealers have left the industry because of the cost and time it takes to get aircraft certified. This is on top of falling margins due to the economy slowing, making it even harder to increase revenue. Five to ten years ago, dealers were able to get aircraft certified in 7–10 days, but now the average time is one month, and appears it will climb further (T. Sipantzi, personal communication, October, 5, 2013, K. Blevins, personal communication, October, 7, 2013).

This situation would push the author to recommend leasing already certified aircraft for training purposes. In time, once the military has an established program with experienced instructors and maintenance personnel the shift to buying aircraft might be a worthwhile consideration. Regarding aircraft used in real operations, they would have to be purchased by the government directly, because often they would be destroyed or severely damaged.

B. BARGAINING POWER OF SUPPLIERS

As stated in the beginning of this chapter, Air Creation USA, Airborne, Evolution, Concept Aviation, Manta Aircraft S.A., and North Wing Design compile the list of manufacturers for the WSC aircraft. In the context of Porter's five forces model, they would be considered the suppliers for the aircraft sales industry. Their bargaining power would be considered neutral because of several competing reasons.

First, the overall demand by the end customer has been decreased by a slow economy, causing prices to be depressed across the board. If consumer demand was higher overall, profit margins for both suppliers and dealers would be higher, allowing suppliers more bargaining opportunities with dealers. The second and final factor that affects suppliers negatively is that their product is not very unique and does not require much in switching costs. WSC aircraft are fairly similar, giving dealers the ability to sell different companies aircraft without considering switching costs (i.e., training, education, testing equipment). The first positive factor for the suppliers is that there are not many of them. Dealers do not have a ton of options to choose from so that tends to give suppliers the upper hand. A second factor that neutralizes dealers is the ability of the manufacturers to integrate forward into selling the aircraft directly to trainers and pilots, cutting dealers out of the picture all together.

C. BARGAINING POWER OF CUSTOMERS

Customers, made up of trainers and recreational pilots, do not retain much bargaining power due to already thin profit margins being made by dealers. Dealers are already just getting by and are not able to go lower, experiencing a 50% reduction in profit margins since 2008. In addition, since buyers are purchasing single units they do not have the ability to negotiate the price with bulk buys. Additionally, the customer base tends to be higher income individuals that care more about quality and safety, consequently reducing the desire to find the cheapest aircraft.

If the government were to buy aircraft in bulk, they might be able to reduce the price by 10%, but any more than that would be difficult, because of where the profit margins already sit. Future government sales, along with maintenance plans and life cycle support arrangements would also put the government in a better position for negotiating lower prices.

D. SUBSTITUTE PRODUCTS

North Wing Design and Airborne have the most closely aligned product line in the industry, where they focus on portability, lightweight components, and a quiet ride. They also match up with price and quality. One substitute product for them that would still be in the WSC aircraft industry would be the Evo. The Evo is described as a cross-country WSC aircraft because of its larger size and engine. A bigger price tag comes with this increased size and speed though, with the Evo model running twice that of the North Wing and Airborne models at $60,000. Since the North Wing and Airborne models are at the lower end of the WSC aircraft industry as far as cost and simplicity they do not have a lower end substitute. To find possible substitutes you would have to look at hang gliders, powered parachutes, and possibly small single person helicopters. The variety of sport aircraft plays a rather significant role in the prices dealers can place on WSC aircraft.

E. JOCKEYING FOR POSITION

The final competitive force in Porter's model is jockeying for position. In the past, the industry had more of this, with more companies selling aircraft and competing on price. As discussed earlier in this chapter, the industry in the last five years has become less competitive as the overall demand for aircraft has slowed. With slowing demand, many dealers have left the business or are doing it part-time as a weekend hobby business. Additionally, profit margins have decreased by 50% on aircraft, drastically reducing the ability of dealers to compete with each other on price.

According to Mr. Porter, the two characteristics of the industry that would normally contribute to an environment of price-cutting are that the dealers are roughly equal in size, and the industry is suffering from a period of slow growth. What counteracts these forces are low-fixed costs and low-barriers to exit. Dealers simply close up shop and look for a different job, rather than lose money. Regional demand has also limited the jockeying companies can do to capture more business from competitors. Customers in the industry want to test fly the aircraft in their home environment and consequently want to work with a local dealer.

If the U. S. Government were to establish a requirement for 30 WSC aircraft a year for training and operations, the level and intensity of jockeying among dealers and manufacturers would most likely change. Between the Buy American Act (BAA) (41 U.S.C 10a) and the Berry Amendment (10 U.S.C. 2533a), DoD procurement officials would not be able to purchase from Airborne) With Airborne out, North Wing would have the lead in the competition due to its product line's specifications matching up with the military's desired requirements. As discussed earlier, profit margins are very thin on aircraft sales, but if North Wing were to win a government contract, they might be willing to go even lower on margins. This would alter the dynamics in the industry and push North Wing into the lead.

V. CURRENT MILITARY TRAINING FOR THE NAVY'S SH60 HELICOPTER

In this chapter, we will discuss the current training practices being conducted with the Navy's SH60 helicopter. The SH60 aircraft was chosen for comparison because of its similarities to the WSC aircraft. Some of the most apparent ones are payload capacity, size, and missions. Before getting into the training program, an acknowledgement of the vast differences of the two aircraft should also be given. The three key differences are the SH60's advanced avionics, anti-submarine warfare capabilities, and munitions carrying capacity. These characteristics are developmental (non-commercial) additions to basically a commercially-available aircraft. From conventional thinking, the training required for these items would have to be given by active duty (and possibly reservist) military trainers. Their argument would be based on needing to know current applications in real world scenarios and the classified nature of the systems. With that, and the length of the training for SH60s (two-and-half years) in mind, the following paragraphs will discuss how their training is structured.

The SH60 Navy helicopter-training program begins with students being sent to civilian flight schools for initial flight screening (IFS). During this phase, civilian instructors conduct introduction flights on commercial Cessnas. This is done in the first two months to measure student pilots' motivation and skill level, before moving on to the next phase. During the next 8 months, students are trained on T-34Cs, which is a fixed wing aircraft. This phase is called primary flight training (PFT) and the instructors are civilians. Civilian instructors also use simulators throughout the first year.

During the next 8 months, student pilots are trained by military instructors on a commercial helicopter, the Bell-206. This phase is called Advanced Flight Training (AFT). AFT is followed by the final phase, called Replacement Aircrew Group (RAG), which lasts 12 months. During this final phase, the student pilots are trained by military instructors on the SH 60.

All Student Naval Aviators (SNA) start their training in Pensacola, Florida. From there, SH 60 student pilots are trained primarily on the Naval Air Station (NAS) in Corpus Christi, Texas. The other two widely-used training airfields are NAS Whiting Field, Milton, Florida, and Vance Air Force Base (AFB), Enid, Oklahoma. Some of the SH60 pilot training in the earlier phases are done on those bases. The location of these sites (South and Southeast) is based on plenty of open air space, low cost of living, and for the most part, predictable warm weather.

The aviation training aircraft are purchased, not leased, by the U.S. military. Conventional thinking among government contracting and acquisition professionals is that procurement is the best route for aircraft. As we will see in the next chapter with the WSC aircraft, manufacturers/dealers charge heavy leasing fees, because the aircraft are mostly worthless after the lease ends. On the other hand, maintenance, is contracted to private companies, because the military does not have enough maintenance personnel to rotate from operational commands to the training commands.

VI. BUY VERSUS LEASING OF AIRCRAFT AND THE IDEAL MIX OF CIVILIAN AND MILITARY TRAINING PERSONNEL

A. BUY VERSUS LEASE

According to Blevins, leasing is not the most economical option, and is not recommended. Leasing an aircraft for one year would cost $25,000 to $31,000 (personal communication with K. Blevins, November 15, 2013; and Globensky, October, 2013). The government could buy the same aircraft for $60,000. The reason for the high price on leasing is that when the lease runs out, manufacturers/dealers can only sell the aircraft for a few thousand dollars. Additionally, the time and administrative costs getting it re-certified with the FAA would be prohibitive for manufacturers/dealers. The only advantage for the government is not having to deal with maintenance and disposal costs. With maintenance and disposal costs being relatively minimal, the advantage is a minor one.

B. THE IDEAL MIX

Chapters III and IV analyzed and described the training and aircraft sales industry of the civilian WSC aircraft, describing the forces that determine how competitive it is in nature. This chapter will draw on that analysis to generate the ideal training environment for the military. In doing so, costs will be generated that depict the future landscape for a military training school in Yuma, Arizona.

After analyzing the two industries, this author has determined that a mix of civilian and military training elements should be utilized in the overall training of the SOAMV. The reasons for a civilian/military partnership are inadequate capacity in different elements by different entities. First, the military does not have any experience in this aircraft. Without experienced military instructors, it would be prudent for the military to leverage the private sector's experience and cost structure, in establishing and running the schoolhouse. Second, the private training industry does not have the facilities, nor would it make sense to build them, when the military has the space and the support facilities on the Yuma Proving Ground base, along with other bases in the Southwest United States.

As discussed in Chapter V, the two main reasons for military personnel that run military flight programs are: 1) pilots need a break from deployments; and 2) the military tactics taught in the later stages of flight school are best taught by active duty personnel. The SOAMV training program is far shorter than helicopter schools or any other flight program. Taking into consideration the SOAMV being a short, and for the most part, a non-tactical training program, the above-mentioned reasons for employing military personnel do not necessarily apply. Additionally, military instructors would be U.S. Special Forces personnel, and would have numerous non-deployable jobs to choose from. This would also alleviate the pressure to use military instructors. Cost savings using contracted personnel would be significant for the program as well.

The trend of contracting out training and maintenance support for military activities has grown considerably since 2001. Many issues have surfaced with this trend in Iraq and Afghanistan, as well as other locations in the world and stateside. In their book, The Responsible Contract Manager, Steven Cohen and William Eimicke, state two reasons when it is never a good idea to contract out. First, if there will be a "negative impact on a capacity that an organization wishes to retain and develop." Second, by contracting a function, it will reduce the ability to ensure accountability in an area where accountability is critical. Additionally, the government's policy on Inherently Government Functions must be considered (Cohen & Eimicke, 2010, p. 47) .

VII. OPTIMAL GOVERNMENT TRAINING SITE AND EXPECTED COSTS

This chapter will describe the Independent Government Estimate (IGE) for a SOAMV training school located at U.S. Army Yuma Proving Ground in Yuma, Arizona. The first part of the chapter discusses synergies available with a SOAMV schoolhouse and related activities, low cost of living considerations, along with weather, terrain, and other optimal flying and training conditions.

A. BACKGROUND OF YUMA PROVING GROUND

U.S. Army Yuma Proving Ground tenant commands are Military Free Fall School, Special Operations Terminal Attack Controllers Course (SOTACC), Test Measurement and Diagnostic Equipment (TMDE) Support Laboratory, and Aerostat. Yuma proving ground falls under Army Test and Evaluation Command, with its primary mission to conduct tests on medium and long range artillery, aircraft armament and fire control systems, cargo and personnel airdrop systems, unmanned aerial systems, armored vehicles and automotive equipment, and technologies for defeating roadside bombs. The base owns 1,300 square miles, contains six airfields and controls 2,000 miles of restricted airspace. The combination of military support, expertise, and SOAMV related training are compelling reasons for a SOAMV schoolhouse and training center to be established there.

B. OPTIMAL WEATHER, TERRAIN, AND COST OF LIVING

The open-air cockpit and the aircrafts total lightweight nature are characteristics that would require, at least in training, the combination of warm weather, dry air, and low winds. The desert surrounding Yuma has those features. The desert terrain is also extremely similar to real world operational environments in the Middle East. The need to train on sand, dirt, and pavement would all be covered by Yuma’s terrain. Additionally, the topography that includes small mountains and shallow gorges are excellent for maneuver training that simulates operational environments of the Middle East.

In addition to their ideal climate and topography, the cost of living in Yuma is the lowest in the country. As seen in Table 1, their per diem rates lead the list of possible locations for the schoolhouse. Commercial flights to the area are common and relatively inexpensive, and critical for getting personnel in and out of the training area without incurring heavy travel costs. Students would most likely combine SOAV training with Free Fall refresher training.

Location	Lodging	Meals and Incidentals
Yuma, AZ	$78	$46
Fayetteville, NC	$94	$51
Tacoma, WA	$105	$61
San Diego, CA	$133	$71

Table 1. Comparative Per Diem Costs (from GSA per diem rates, 2013)

C. PER DIEM COSTS FOR STUDENTS

The training syllabus proposed has a three-week class schedule. The expected number of students is 30 for each three-week class. With one week of instructor preparation before each class start date the total number of students expected to graduate each year are 300. Table 2 illustrates the annual per diem costs associated with each 300 students graduating from a schoolhouse located in Yuma.

# of Students per Class	Individual Per Diem Per Day	Daily Per Diem Expense Per Class	Monthly Per Diem Expense Per Class (21 days)	Total Annual Per Diem Cost Per Class (10 months)
30	$124	$3,720	$78,120	$781,200

Table 2. Per Diem Costs for Students

D. COST OF INSTRUCTORS

A contract would be set for three civilian instructors each making $35 an hour. This would be based off a 40-hour week for 10 months out of the year, for a total of 120 hours multiplied by 10 months. The total pay for three civilians would come to $168,000 a year. Military instructors would be at the rank of E-7. An E-7's pay package for the

Yuma area is $5,377 per month. With three military instructors, the total yearly cost would be $193,572. Combining the military and civilian yearly instructor costs would give you a total of $361,572.

E. WSC SIMULATORS

There is currently not a WSC simulator on the market. In contrast, there are several small to large-scale general aviation simulators being sold in the market place. Redbird, Elite, and Mechtronix have a wide selection of state of the art simulators. Prices range from a few thousand dollars for the desktop versions to $60,000 for enclosed cockpit models. The general consensus from WSC civilian trainers is that anything more than a basic personnel computer desktop version would exceed what is needed or desired. There are several producers of the inexpensive, personnel computer programs that simulate the basics of aviation. There seems to be enough basic aviation training with the PC simulators for WSC training.

For the purpose of determining costs associated with simulators for the school house the estimate of 4 PC simulators at $2,000 would be appropriate for the first year. Each passing year it would make sense to budget for the replacement of one, adding a line item of $2,000 for annual simulator costs.

F. OPERATIONS AND MAINTENANCE (O&M) COSTS

O&M costs are based on the North Wing Scout XC model and the hourly operating cost of $43.80. The schoolhouse would own 13 aircraft and each would operate approximately 2,000 hours a year. Given these numbers, the total annual O&M expense would be $22,360.

G. TRANSPORTATION VEHICLES

Three trucks (four passenger), four vans (eight passenger) and one bus (36 passenger) would be needed for trainers and the shuttling of students between classrooms, airfield, and lodging. This would be a General Services Administration (GSA) lease. Expected costs would be $95,000 annually. In addition to the vehicles, fuel costs would be approximately $34,000. This amount is rather large because of how spread out the base is and the traveling required between lodging, classrooms, and the airfield.

H. OFFICE SUPPLIES, MEDICAL SUPPLIES, AND COMMUNICATION EQUIPMENT

Office supplies for this size schoolhouse are expected to run around $15,000 per year. Medical supplies, to include water and other health and comfort supplies would cost $50,000 per year. Communication equipment, to include cell phone, projectors, computers, will cost approximately $24,000 per year. Startup costs for communication equipment in the first year would be $125,000. This figure takes into account buying 35 computers for classrooms and offices, four projectors, and eight cell phones.

I. HANGERS, CLASSROOMS, AND OFFICE SPACE

Yuma proving ground has plenty of space and a relatively large amount of support facilities (housing, dining, MWR, medical, etc.) but it does not have the required hanger, classroom and office space needed for a SOAMV schoolhouse. These three facilities would have to be constructed before the opening of training. This author's recommendation is to purchase mobile classrooms and offices, either conex boxes (shipping containers), or prefabricated structures on wheels. The hanger would be constructed of lightweight materials that would keep costs down, and could also be disassembled and used again somewhere else. The mobility and reuse ability of the school not only keeps costs down, but allows for movement of it to other installations if it makes sense to do so. With regards to the WSC aircraft, this decision goes along with the recommendation of U.S. Special Forces personnel of "buy it and try it." Table 3 displays costs associated with the facilities.

Item	Construction costs
Hanger (100 x 200 ft)	$158,000
Classroom	$42,000
Office Space	$16,000

Table 3. Procurement Costs of Temporary Facilities

J. PROFESSIONAL DEVELOPMENT OF TRAINERS

This is a major expense for any schoolhouse and would be no different for the SOAMV program. Professional development would consist of re-qualifications/certifications, industry conferences, and meetings with SOCOM leadership. Travel would be a large part of this cost but is unavoidable no matter where the schoolhouse would be located due to the geographical dispersion of industry, government regulators, and military installations. This would be an annual investment of approximately $150,000.

K. FIRST YEAR AND ONGOING ANNUAL COSTS

Table 4 provides a summary of the final estimated costs. The first year costs include start-up costs and annual costs in that first year. Ongoing annual costs would be for each subsequent year.

Cost Category	First-year Costs	Ongoing Annual Costs
Aircraft (13 x $60,000)	$780,000	$0
Aircraft O& M	$22,360	$22,360
Instructors	$361,572	$361,572
Student Per Diem	$781,200	$781,200
Simulators	$8,000	$2,000
Vehicles and Fuel	$129,000	$129,000
Office and Medical	$65,000	$65,000
Communication Eq.	$125,000	$24,000
Professional Development	$150,000	$150,000
Hanger, Classroom, office	$216,000	$0
Total	$2,638,132	$1,535,132

Table 4. First Year and Ongoing Annual Costs

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VIII. CONCLUSION

This project started with a big picture look at the requirement for a WSC aircraft in U.S. military and ended with a detailed estimate of costs for a training school. In between was an analysis of the training industry, aircraft sales industry, and a look at the structure of military aviation training. A summary of the major findings is found in the below paragraphs that conclude the project.

A. SUMMARY OF MAJOR FINDINGS

The U.S. military faces numerous threats and mission requirements in today's world of IW. Each one calls on a different weapon system or platform to provide mission success. This project found there is a need for the Osprey and Predator to carry out certain missions, but it also found that there is a capability gap with OA that requires the SOAMV. In the process of analyzing the training industry, the project brought to light that small, one or two person-training centers are the standard across the U.S. Additionally, a regionalized customer base and overall low demand creates a relatively non-competitive industry. Another major factor affecting the industry is the Federal Aviation Administration's recent inclusion of the WSC aircraft into the Light-Sport aircraft category. This inclusion added costs and time to training, causing demand to dramatically fall across the country. For the aircraft sales industry, similar dynamics were found. Demand for the aircraft has dropped 75% since the FAA rules tightened in 2010.

Lastly, the project looked at current military aviation training and the future training structure of the SOAMV and its ideal training location and associated costs. The project specifically examined the Navy's SH60 helicopter training program, which showed a mix of military and civilian trainers involved in the different phases, with civilians instructing student pilots in the first year and military pilots instructing in the second year. This arrangement works well for a training program like the SH60 because of the time it takes to master basic flight skills and then move on to advanced weapon systems training.

In the case of the SOAMV, the training required is only three weeks. The much shorter training program is due to the simple nature of the WSC aircraft, and the fact it does not have military weapon systems. Considering those two aspects of the aircraft, the need for military instructors is greatly diminished. The author contends that three civilian and three military instructors on staff is the correct mix of the two. Both civilian and military instructors have unique skill sets that students would benefit from. The numbers of each could fluctuate by one, but at all times there should be at least two of each. Additionally, Yuma Proving Ground was selected as the best location based on optimal training conditions, installation support services, and value to taxpayers. The first year costs for a schoolhouse in Yuma are estimated to be $2,638,132.00, with ongoing annual costs estimated at $1,535,132.00. The author generated these cost estimates using comparable costs from the Military Free Fall school in Yuma, AZ.

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